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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/037,586	01/04/2002	Hsueh-Heng Liu	TS98-420	6504

28112 7590 05/08/2003

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EXAMINER
GEYER, SCOTT B

ART UNIT	PAPER NUMBER
2829	

DATE MAILED: 05/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/037,586	LIU, HSUEH-HENG	
	Examiner	Art Unit	
	Scott B. Geyer	2829	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 March 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *12-23* is/are allowed.

6)☒ Claim(s) *1 and 11* is/are rejected.

7)☒ Claim(s) *2-10* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Information Disclosure Statement

1. The references cited on the IDS (paper no. 2) have been considered.

Drawings

2. The drawings submitted by the applicant on January 4, 2002 are acceptable.

Specification

3. The disclosure is objected to because of the following informalities:

Page 1, line 11: delete comma after "arrays";

Page 1, line 26: insert space between "5,807,786" and "(Chang)";

Page 2, line 9: insert space between "5,508,220" and "(Eltouhky et al.)";

Page 2, line 9: insert space between "5,763,299" and "(McCollum et al.)";

Page 2, line 11: insert space between "5,807,786" and "(Chang)";

Page 3, line 6: change "creating" to - - created - -;

Page 3, line 8: delete first two commas;

Page 3, line 14-15: clarify "using a chemistry";

Page 3, line 19: de-capitalize "Amorphous";

Page 4, line 7: change "5, and 6" to - - 5 and 6 - -;

Page 5, line 4: clarify "using a chemistry";

Page 5, line 11: de-capitalize "Amorphous";

Page 5, line 23: change "process" to - - processes - -;

Page 6, line 2: delete comma after "transistor";

Page 6, line 5: delete comma after "structure";

Page 6, line 6: delete first two commas;

Page 6, line 13: define acronym "R.F.";

Page 6, line 16: capitalize "r.f." (for consistency with page 6, line 13);

Page 6, line 26: delete comma after "polishing" and after "(CMP)";

Page 6, line 28: define acronym "RIE";

Page 6, line 29: insert space between "CHF_3" and "as";

Page 7, line 2: change "**100**" to - - **100** - - (bolded font for consistency);

Page 7, line 3: delete comma after "layer 5";

Page 7, line 4: delete comma after "deposition" and after "(LPCVD)";

Page 7, line 17: delete period after "C";

Page 7, line 18: delete comma after "7";

Page 7, line 25: change "anti-fuse" to - - antifuse - - for consistency;

Page 7, line 27: delete comma after "layer";

Page 7, line 29: delete comma after "shape" and after "mask";

Page 7, line 30: delete period after "FIG" for consistency;

Page 8, line 6: delete "walls";

Page 8, line 10: change "spacer" to - - spacers - -;

Page 8, line change "has" to - - have - -;

Page 8, line 15: change "SIN" to - - SiN - -;

Page 8, line 27: capitalize "r.f." for consistency;

Page 9, line 5: de-capitalize "Anisotropic";

Page 9, line 6: delete comma after "CF_4";

Page 9, line 15: change "10*b*" to - - 10B - - for consistency;

Page 9, line 18: insert - - and - - between "5" and "10B";

Page 9, line 18: delete period after "FIG" for consistency;

Page 9, line 19: delete periods after "FIG" for consistency;

Page 9, line 24: de-capitalize "Stripper";

Page 9, line 25: de-capitalize "Antifuse";

Page 9, line 27: de-capitalize "Amorphous";

Page 10, line 1: change "inventions" to - - invention's - -;

Page 10, line 10: de-capitalize "Amorphous" and "Antifuse";

Page 10, line 20: change "anti-fuse" to - - antifuse - -;

Page 10, line 21: change "anti-fuse" to - - antifuse - -;

Page 10, line 21: de-capitalize "Amorphous";

Page 10, line 23: capitalize "this";

Page 10, line 28: change "16 18" to - - 16 and 18 - -;

Page 10, line 28: de-capitalize "Amorphous";

Page 10, line 28: delete hyphen;

Page 11, line 2: insert - -) - - after "loss.".

Appropriate correction is required.

/

Claim Objections

4. Claims 1, 2, 7, 9, 10, 11, 12, 16, 18, 21 and 23 are objected to because of the following informalities:

Claim 1, line 1: insert - - an - - between "having" and "amorphous";

Claim 1, line 2: delete space between "spacers" and the comma;

Claim 1, line 14: delete space between "antifuse" and the semi-colon;

Claim 2, line 5: define acronym "RIE";

Claim 2, line 8: delete apostrophe and insert semi-colon;

Claim 2, line 10: change "where by" to - - whereby - -;

Claim 7, line 2: define acronyms "PECVD" and "CMP";

Claim 9, line 2: change "02" to - - O_2 - - for "NF_3" and "SF_6" (i.e. change the zero to the letter 'O');

Claim 9, line 2: delete comma after "O_2";

Claim 10, line 3: delete period after "C";

Claim 11, line 2: delete comma after "nitride";

Claim 12, line 1: change "a" to - - an - -;

Claim 12, line 27: change "siad" to - - said - -;

Claim 16, line 2: change "final a thickness" to - - final thickness - -;

Claim 18, line 1: capitalize "r.f.";

Claim 21, line 2: delete period after "C";

Claim 23, line 2: delete comma after "nitride".

Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain et al. (6,107,165) in view of Hawley et al. (5,804,500).

7. As to ***claim 1***, Jain et al. teach a method of making an antifuse, as described by figures 2-18. In figure 2, an insulator layer 6 is deposited over a substrate 1 which may have logic circuitry of a FPGA. A via hole 7 is formed in the insulator layer 6. A metal plug 12 (for example, tungsten) is formed in the via hole 7. A layer 20 of programmable material, such as amorphous silicon (see column 4, lines 32 et seq.) is deposited over the metal plug 12 to form an antifuse. Metal layers (see figure 17, numerals 26, 27 or 28) are then formed over the antifuse. The metal layers are then patterned (see column 6, lines 15 et seq.). Jain et al. also teach an embodiment wherein spacers 30 are formed on the sides of the antifuse, and the spacers can be formed of silicon nitride (see column 6, lines 60-61 and also figure 18). Although Jain et al. do teach active elements in a semiconductor substrate (column 3, lines 10 et seq.), Jain et al. does not specifically teach forming a first interconnect structure contacting the active elements in the substrate. However, Hawley et al. teach a lower conductive electrode 14 (see figure 1) which is a metal layer used as an interconnect layer in the integrated circuit (column 2, lines 53 et seq.) At the time of the invention, it would have

been obvious to a person of ordinary skill to modify the method of Jain et al. with an interconnect structure as taught by Hawley et al. to provide a connection between the circuitry of the underlying substrate and the antifuse.

8. As to ***claim 11***, Jain et al. teach the patterned second metal interconnect structure composed of a standard sputtered aluminum layer (AlSiCu) (see column 6, lines 6 et seq.).

Allowable Subject Matter

9. Claims 2-10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art of record and to the examiner's knowledge does not teach or suggest the limitations disclosed in the above claims. For purposes of brevity, those limitations will not be repeated, however, if the applicant desires to incorporate those limitations, it is noted that the complete claim limitation must be incorporated into the base claim.

10. Claims 12-23 are allowed.

11. The following is a statement of reasons for the indication of allowable subject matter: the applicant has disclosed in independent claim 12 a method of forming an antifuse based interconnect structure, wherein the antifuse is composed of amorphous silicon and sidewall spacers are composed of silicon nitride. Claim 12 details steps of forming the antifuse including forming a via hole in an insulator layer, lining the via hole with titanium nitride, depositing tungsten to fill the hole, forming an antifuse of

amorphous silicon on the metal plug with sidewall spacers, forming a metal layer over the antifuse and etching the metal layer with Cl_2 or BCl_3 using reactive ion etching. The following references are made of record as art related to applicant's invention: Hsu et al. (6,265,257 B1), Hawley et al. (6,124,193), McCollum et al. (5,763,299), Hawley et al. (5,308,795) and Wong et al. (5,250,464). The prior art of record, and to the examiner's knowledge does not teach or render obvious, at least to the skilled artisan, the instant invention regarding forming an antifuse based interconnect structure, as recited by the stepwise method (steps A through O) of applicant's independent claim 12. Claims 13-23 are dependent upon claim 12.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott B. Geyer whose telephone number is (703) 306-5866. The examiner can normally be reached on weekdays, between 10:00am - 6:30pm. The examiner may also be reached via e-mail: scott.geyer@uspto.gov

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamand Cuneo can be reached on (703) 308-1233. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SCOTT GEYER
PATENT EXAMINER

SBG
April 29, 2003

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